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EXCESSIVE EXPANSION OF DENTAL AMALGAMS

A research has just been completed by I. C. Schoonover and associates which explains the reason for excessive expansion of dental amalgams—a defect which has so frequently puzzled the dentist.

Dental alloy when amalgamated should expand slightly (about 8 microns per centimeter) when it sets and, after 10 to 20 hours, should show no further expansion. In some instances, however, specimens have been observed to expand over 200 microns in 30 days.

Records show that these excessive expansions occur only with alloys containing zinc and then only if the alloy is contaminated with salt solutions (e. g., NaCl) obtained from the perspiration of the palms. Salt added intentionally during amalgamation produces similar expansion. Gas pockets were found in such expanding amalgams, in some instances the pockets having broken through the surface of the amalgam as blisters. The gas has been identified as hydrogen. The pressure in these pockets builds up and, after 24 to 48 hours, is sufficient to cause the specimen to expand or "spheroid."

Nonzinc alloys do not show this abnormal expansion nor do zinc-containing alloys if they are amalgamated in a clean mortar or a mechanical amalgamator and are not contaminated by handling.

These results should not be construed as an endorsement of zinc or nonzinc alloys but rather should be accepted as a justification for the utmost care and cleanliness in handling these alloys.

The complete report is being prepared for publication in a future issue of the Journal of the American Dental Association.

SIMPLIFIED PRACTICE AND THE DEFENSE PROGRAM

To assist in the organization and development of the Government's program for conserving essential materials and labor during the present emergency, Edwin W. Ely, chief of the Division of Simplified Practice, has been transferred to the newly organized

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conservation division of the Office of Production Management.

Under the procedure as now worked out, interested groups in industry may, as in the past, initiate simplification projects. However, these may now be originated also by the Government. Recommendations will be worked out in general conferences in which industry, OPM, and other participating Government agencies will be represented. The Bureau is developing methods of procedure to expedite the completion of projects, while the Bureau of Foreign and Domestic Commerce is acting as a liaison agency between Government and industry.

COPPER TANKS IN INDUSTRY

Copper tanks, vats, and containers of various shapes and sizes are widely used in industry. Some of these are of very large size. Although the necessary information is available on which to base recommendations as to the chemical uses to which such containers may safely be put, information which will serve as a guide in their mechanical construction and assembly is woefully scant. Rule-of-thumb methods must be used or dependance placed on principles established for corresponding steel construction. To meet the need for this information, the Copper and Brass Research Association, a technical organization representing the copper and brass industry, has just established a new industrial research project in the Bureau's Division of Metallurgy dealing with this subject. A good deal of testing work will be required to assemble the necessary data on the basic mechanical properties of flat copper in different gages and tempers. Another subject that will require study is the determination of the strength and general durability of the various joints used in such construction work. Finally, all the data and information must be assembled and correlated with the basic engineering principles of construction so as to be readily usable by designers and builders.

STRESSES IN RIGID FRAMES

Engineers have for some time been interested in the distribution of stress in the knees of rigid frames. Numerous tests have been made to determine this distribution; but tests alone are of limited value unless they permit generalization, that is, unless it is possible to predict the behavior of other similar but different structures on the basis of the tests. One method of generalizing consists in analyzing tests by well-founded theory which is not restricted by the particular dimensions of a test specimen nor the conditions of loading. If the limitations of the theory are kept in mind, wide generalization is often permissible.

In J. Research NBS 21, 269 (September 1938) RP1130, an analysis was given of the stresses in a rigid frame. A further development of this work by William R. Osgood is reported in the Journal of Research for November (RP1431). The analysis here presented is more accurate than the earlier one.

WATER PERMEABILITY OF MASONRY WALLS

The effects of weathering exposure on the water permeability of about 100 small masonry walls has been observed by exposing the walls outdoors at Washington for a period of 2 or 3 years. The permeability of the walls was determined both before and after outdoor storage by testing them under conditions which produced the effects of a wind-driven rain. Some of the walls that had leaked badly when first constructed had been waterproofed before being exposed outdoors and the durability of the waterproofing treatments was also observed.

The information obtained through these tests has now been published as Building Materials and Structures Report BMS76. Copies are obtainable from the Superintendent of Documents, Government Printing Office, Washington, D. C., for 15 cents.

The weathering exposure did not have an important effect on the permeability of all-brick or brick-faced walls that were 8 inches or more in thickness. Stucco-faced walls with tile backings were more permeable after exposure than before, but their performances were still satisfactory. Cutting out and repointing the face joints was the most effective and durable of the waterproofing treatments.

The application of a portland cement grout, thinly applied with a brush to the joints of a brick wall, was still effective after 3 years of exposure, although the permeability of the walls, so treated, had increased. Both oil and cement-water paints were still effective as waterproofings after 3 years, although showing evidence of wear.

COMMERCIAL STANDARD FOR PORTABLE ELECTRIC DRILLS

Portable Electric Drills (Exclusive of High Frequency) is the title of Commercial Standard CS93–41, which has just been released in printed form, and which should serve as a basis for better understanding between buyers and sellers.

The standard provides minimum specifications for Class A, heavy-duty, and Class B, standard, rotary electric drills manufactured in eleven standard sizes ranging from 3/16 inch to 1½ inches. It includes specific requirements for construction, minimum full-load ampere rating, tests, name plates, and a uniform method of certifying compliance with the standard.

The voluntary basis provided for certification from seller to buyer will constitute a legally binding assurance that these portable drills are not only safe in the hands of the user but that they will perform in service as indicated on the name plate. The standard will also serve as a yardstick for measuring the performance and general desirability of portable drills of lower ratings (not conforming to the standard) and of any which may materially exceed the standard ratings. It should also materially reduce the possibilities of misunderstandings in connection with purchases and form a nationally recognized basis for fair competition.

The standard will become effective for new production on October 18, 1941. Copies are obtainable from the Superintendent of Documents, Government Printing Office, Washington, D. C., at 5 cents each.

COMMERCIAL STANDARDS FOR CALKING LEAD, LEAD PIPE, AND LEAD TRAPS AND BENDS

Three pamphlets of interest to the plumbing trade and the chemical, manufacturing, and construction industries have just been issued by the Bureau. These are: Calking Lead, Commercial Standard CS94–41; Lead Pipe, Commercial Standard CS95–41; and Lead Traps and Bends, Commercial Standard CS96–41.

CS94–41 covers chemical composition, certification, labeling, and packaging of one grade of calking lead available in pig, ingot, or wool form.

CS95–41 is concerned with chemical composition, inside and outside diameters, weight classification, weight per foot, defects, certification and labeling of one grade of lead pipe. Maximum working pressures are included in Table 1 to assist in the selection of the proper classification of lead pipe for various purposes.

CS96–41 establishes standards for chemical composition, defects, markings, weights and dimensions, with allowable deviations, for one grade in various sizes of full S traps, ½ S or P traps, drum traps, and bends.

These standards became effective from June 25, 1941. Copies are obtainable from the Superintendent of Documents, Government Printing Office, Washington, D. C., at 5 cents each.

THE PLANOFLEX FOR EVALUATING THE PLIABILITY OF FABRICS

The "hand" or "feel" of fabrics and its evaluation are important alike to the finisher, manufacturer, and consumer. With the advent of many new fibers and textile finishing agents the tactual method of determining hand has become inadequate. Accordingly, the American Society for Testing Materials and the Bureau, with the support of the textile industry are developing quantitative objective test methods and instruments. The first of these is the Planoflex, which is used to evaluate the pliability of a fabric, one of the chief components of hand. It is described in a report (RP1434) by Edwin C. Dreby, which will appear in the November number of the Journal of Research.

The Planoflex is used for measuring the extent to which a fabric can be distorted in its own plane without producing wrinkles on its surface. Results of measurements on a series of cotton percales showed an 88-percent correlation with their tactual pliability ratings. The Planoflex appeared to be considerably more sensitive than the experts in the range of pliability exhibited by these fabrics.

The Planoflex was shown to be as good as, or better than, the Schiefer Flexometer and the Peirce Hanging-Heart Loop methods for evaluating pliability with respect to the extent of the correlation between measured values and tactual pliability ratings, sensitivity to small differences in pliability, and ease of operation.

The Planoflex will give measurable values on all woven fabrics except those that are so heavily starched that the filling and warp threads are cemented together. It is not applicable to knit fabrics since they are so easily stretched and distorted that they can not be mounted in the instrument.

Since the construction of a fabric affects to a large extent its angle of distortion, measurements with the Planoflex are only comparable for similarly constructed fabrics. The sensitiveness of the Planoflex to slight differences in pliability makes it a valuable tool for comparing quantitatively the effects of different finishing agents. Its simplicity of operation and rugged construction make it particularly adapted to routine testing and control work during the processing of fabrics.

ESTIMATION OF ALDEHYDE GROUPS IN HYDROCELLULOSE FROM COTTON

Degradation of cellulosic materials generally involves the cleavage of cellulose molecules. Such a process results in a material of lower strength. The extent of the degradation can be estimated by a number of physical-chemical methods, involving viscometer, osmometer, or centrifuge measurements in appropriate solvents.

In certain types of degradation, especially those produced by acids, an aldehyde group is produced at each point of cleavage and accordingly the extent of this type of degradation of the cellulose can be determined by direct estimation of the aldehyde groups thus formed.

A number of methods for such estimations have been proposed but there are many disadvantages connected with most of them. The results of an investigation undertaken by A. R. Martin, Leonard Smith, R. L. Whistler, and Milton Harris, research associates of the Textile Foundation at the Bureau, are given in the Journal of Research for November (RP1432). These groups show that the aldehyde can be readily determined by titration with iodine in alkaline solution. Some iodine is consumed under these conditions in oxidizing groups other than the aldehyde groups originally present, but a suitable correction for the amount of iodine used in this way can be made. It is shown that the extent of hydrolytic degradation as determined by this method compares well with similar measurements by the viscosity method.

RESISTANCE OF WOOL TO DIGESTION BY ENZYMES

Wool and other hair fibers belong to the class of proteins called keratins, and characteristically are extremely resistant to digestion by enzymes. However, certain living organisms, such as the common clothes moth, the carpet beetle, and several molds, readily attack wool. Such destruction apparently is accomplished by means of enzymes produced by these organisms. An investigation by Walton B. Geiger, W. I. Patterson, L. R. Mizell, and Milton Harris, research associates of the Textile Foundation at the Bureau, the results of which are reported in the November Journal of Research (RP1433) has now shown that wool fibers that have neither been injured mechanically nor modified chemically, are resistant to attack by enzymes and that this resistance is dependent upon at least two factors.

One factor is the resistance of the outer layer or cuticle of the individual fibers. The other is the peculiar chemical structure of wool, in which main chains of molecules (polypeptides) are linked together by disulfide cross-links formed by pairs of sulfur atoms, to form a three-dimensional network.

When the outer layer of a wool fiber is damaged by mechanical means, the fiber becomes susceptible to attack by enzymes. Under these conditions only a certain small portion of the wool is digested, but nevertheless the fibers are considerably weakened and their fibrous structure is partly destroyed. Even more deleterious are chemical changes that break the disulfide cross-links. After such changes, the wool can be rapidly and almost completely digested.

The results suggest that chemical operations which tend to break disulfide cross-links, such as scouring with alkalies or bleaching with peroxide, should tend to decrease the resistance of wool to attack by biological agents. These results are also in agreement with the conclusions of other investigators, who have shown that moths digest wool through a process which involves rupture of the disulfide groups in their intestines previous to enzymatic digestion.

Certain chemically modified wools, in which the disulfide cross-links, which are relatively unstable chemically, have been replaced by new cross-links of greater chemical stability, were found to have an enhanced resistance to attack by enzymes and other biological agents.

WALDEN INVERSION IN THE SUGAR SERIES

The acetylglycosyl halides, prepared by reaction of the hydrogen halide upon

the acetylated sugars, and having the halogen attached to the glycosidic carbon, may be used in a wide variety of reactions involving replacement on the glycosidic carbon. Thus, an acetylglycosyl halide may be condensed with alcoholic hydroxyl groups in the presence of a basic condensing agent to form glycosides, substances which are widely distributed in plant and animal life and are of importance in the fields of pharmacology and medicine. In some cases the glycoside formation is accompanied by an intramolecular orthoester reaction; this prevents the production of the desired glycoside in satisfactory yield. In a paper by Harriet L. Frush and Horace S. Isbell in the Journal of Research for November (RP1429), the stereomeric factors which control the formation of orthoesters are discussed in light of the opposite-face concept for the Walden inversion. It is shown that cyclic orthoacetates are formed when an acetyl group can approach the face of a neighboring carbon opposite a replaceable halogen atom. This concept was tested by application of the Koenigs-Knorr reaction to pentaacetyl-α-*d*-α-guloheptopyranosyl bromide and to heptaacetyl-α-neolactosyl chloride. Both of these compounds gave, as anticipated, the corresponding methyl orthoacetates.

PROGRESS REPORT ON THE HYDROCARBONS IN THE KEROSENE FRACTION OF PETROLEUM

During the twenty-second annual meeting of the American Petroleum Institute at San Francisco, November 3 to 7, a paper was presented under the title "Progress report on hydrocarbons in the kerosene fraction of petroleum." This report was prepared by Frederick D. Rossini and Beveridge J. Mair and will be published in the proceedings of the API. The paper describes that part of the work of Research Project 6 dealing with the isolation and identification of hydrocarbons in the kerosene fraction of petroleum, under the following headings: Present status of the work on the gasoline and kerosene fractions; outline of the separation of the kerosene fraction; properties of the hydrocarbons isolated; amounts of the hydrocarbons in the kerosene fraction and in the original crude petroleum. Of the eight hydrocarbons so far isolated and identified in the kerosene fraction, "best" lots were prepared in a high degree of purity, and all of the physical properties were determined. These data were reported in detail by B. J. Mair and A. J. Streiff in J. Research NBS 24, 395 (April 1940), and 27, 343 (October 1941); RP1289 and RP1423, respectively.

REFLECTION-TRANSMISSION RELATIONSHIPS IN SHEET MATERIALS

In RP1430 in the November Journal of Research, Herbert F. Launer shows that values for reflectance of transmissive sheets, diffusing or clear, calculated from transmissions of one and two sheets, agree well with the directly measured reflectances over a wide range of values and wavelengths, for materials such as paper, glass, and an organic plastic. The expression used as a basis for calculations,

$$R_a = \sqrt{1 = (T^2_a / T_{2a})}$$

in which R_a is the reflectance, and T_a T_{2a} are the transmissions of one and two sheets of the material, a, respectively, was derived by considering the infinite series of reflections undergone by light in passing through two sheets. The transmissions are measured with an inexpensive "photoelectric" cell which has been altered slightly from its manufactured form. No reflectance standard is involved, nor does any reflecting surface other than that of the sample play a fundamental part in the method.

The method is not intended to replace present ones, but it does, however, afford a means of obtaining reflectances with simpler equipment and without recourse to reflectance standards. This is especially useful when no reflectance standard is available, as in the infrared region.

TESTING OF TIMEPIECES

Frequent requests for information about the performance of watches and other timepieces under various conditions has necessitated the revision of previously published material and the addition of new general information on the subject of time and timepieces. Circular C432, which has just been released, contains descriptions of the four standard tests for pocket watches, namely, Class A, Class B, Railroad Pre-

cision, and Business Precision—an improved test for stop watches of various types, and a test for ship chronometers. It also includes information on the use and care of a watch, watch sizes, watch jewels, watch-testing machines, standard time and time signals. Directions and general information for the submittal of timepieces for test are also given.

This circular supersedes Circular C392, Testing of Timepieces, published in 1931 and Circular C51, Measurement of Time and Tests of Timepieces, published in 1914. Copies are obtainable from the Superintendent of Documents, Government Printing Office, Washington, D. C., at 15 cents each.

TABLES OF PROBABILITY FUNCTIONS AND OF NATURAL LOGARITHMS

Two new mathematical tables, prepared by the Work Projects Administration for the city of New York under the sponsorship of the Bureau, are now obtainable:

MT8. Tables of Probability Functions, Volume I:

$$H'(x)=\frac{2}{\sqrt{\pi}}e^{-x^2}$$

and

$$H(x)=\frac{2}{\sqrt{\pi}}\int_0^x e^{-\infty^2}d\infty.$$

Values of $H'(x)$ and $H(x)$ from 0 to 1 at intervals of 0.0001 and from 1 to 5.6 at intervals of 0.001 to 15 places; also values of $H'(x)$, $1-H(x)$ from 4 to 10 at intervals of 0.01 to 8 significant figures. 330 pages; bound in buckram; $2.00.

These tables extend the range of all existing tables, and provide a smaller tabular interval. Painstaking care has been exercised to make them accurate. Due provision has been made to facilitate interpolation by the user of the tables, both direct and inverse. The explanatory text is without bias in favor of one particular type of application. The tables are thus presented as the tabulation of a mathematical function, equally available for application to any one of numerous fields.

MT9. Table of Natural Logarithms, Volume II (Logarithms of the intergers from 50,000 to 100,000, to 16 places of decimals.) 519 pages; bound in buckram; $2.00.

These tables extend the range of all existing tables of natural logarithms and provide a smaller tabular interval. They will be particularly convenient for engineers and other practical computers who have frequent use of natural logarithms and wish to obtain them with the least possible effort and time. The tables are not intended to take the place of tables of common logarithms as a multiplying and dividing tool, but rather to furnish values of natural logarithms where directly needed.

Those desiring one or both of these publications should send their orders with remittances to the National Bureau of Standards, Washington, D. C.

Data on the nine tables now obtainable will be furnished on request, and if desired, names will be added to the mailing list for announcements of new publications in this series.

SAFETY RULES FOR ELECTRIC SUPPLY AND COMMUNICATION LINES

Handbook H32, Safety Rules for the Installation and Maintenance of Supply and Communication Lines, which has just been released, is a revision of Handbook H10 and constitutes part 2 of the National Electrical Safety Code as revised for a fifth edition. The rules for overhead lines are concerned with the relative elevation of different classes of lines, avoidance of conflicts, clearances, and climbing spaces, and miscellaneous requirements. Lines are classified into four grades of construction according to the nature of the hazard involved, and requirements for the strength of conductors and of their supports are specified for each grade of construction. The rules for underground lines deal with the protection and separation of buried conductors and cables, the location of ducts and duct systems, their construction, and location and construction of manholes, the guarding of live parts in manholes, the identification of conductors, etc. Rules covering methods of protective grounding have been added. The appendices which appeared in the previous edition have been deleted.

Copies of the new handbook are obtainable from the Superintendent of Documents, Government Printing Office, Washington, D. C., at 65 cents each.

NEW AND REVISED PUBLICATIONS ISSUED DURING OCTOBER 1941

Journal of Research [2]

Journal of Research of the National Bureau of Standards, volume 27, number 4, October 1941 (RP1423 to RP1428, inclusive). Price 30 cents. Annual subscription, 12 issues, $3.50.

Research Papers [2]

[Reprints from August and September 1941 Journal of Research]

RP1407. Thermal expansion of cast and of swaged chromium. Peter Hidnert. Price 5 cents.

RP1410. Effect of grain size and heat treatment upon impact-toughness at low temperatures of medium carbon forging steel. Samuel J. Rosenberg and Daniel H. Gagon. Price 10 cents.

RP1411. Relationship of the garnet-hydrogarnet series to the sulfate resistance of portland cements. E. P. Flint and Lansing S. Wells. Price 5 cents.

RP1412. Microscopic structure of the wool fiber. Charles W. Hock, Robert C. Ramsay, and Milton Harris. Price 10 cents.

RP1413. Behavior of calcium sulfate at high temperatures. Edwin S. Newman. Price 5 cents.

RP1419. Testing and performance of volt boxes. Francis B. Silsbee and Francis J. Gross. Price 10 cents.

RP1421. The system $2CaO.SiO_2$-K_2O. $CaO.SiO_2$, and other phase-equilibrium studies involving potash. William Taylor. Price 10 cents.

Building Materials and Structures Reports [2]

[Persons who wish to be notified of new publications in the Building Materials and Structures series as soon as they are available should write to the Superintendent of Documents, Government Printing Office, Washington, D. C., asking that their names be placed on the special mailing list maintained by him for this purpose.]

BMS76. Effect of outdoor exposure on the water permeability of masonry walls. Cyrus C. Fishburn, Douglas E. Parsons, and Perry H. Petersen. Price 15 cents.

Circulars [2]

C432. Testing of timepieces. R. E. Gould. (Supersedes C392.) Price 15 cents.

Handbooks [2]

H32. Safety rules for the installation and maintenance of electric supply and communication lines. (Comprising Part 2 and the Grounding Rules of the fifth edition of the National Electrical Safety Code.) Bound in cloth. Price 65 cents.

Commercial Standards [2]

CS93–41. Portable electric drills (exclusive of high frequency). Price 5 cents

CS94–41. Calking lead. Price 5 cents.

Simplified Practice Recommendations [2]

R181–41. Nonferrous range boilers. Price 5 cents.

Technical News Bulletin [2]

Technical New Bulletin 294, October 1941. Price 5 cents. Annual subscription, 50 cents.

MIMEOGRAPHED MATERIAL

Letter Circulars

[Letter Circulars are prepared to answer specific inquiries addressed to the National Bureau of Standards and are sent only on request to persons having definite need for the information. The Bureau cannot undertake to supply lists or complete sets of Letter Circulars or send copies automatically as issued.]

LC661. Fire resistance and fire prevention: Publications by the staff of the National Bureau of Standards. (Supersedes LC165.)

LC662. Specifications for the manufacture and installation of four-section and of two-section, knife-edge railway track scales. (Supersedes C83 and C333.)

LC663. Specifications for the manufacture and installation of motor truck, built-in, self-contained, and portable scales. (Supersedes LC152.)

LC667. Leather: Publications by members of the staff of the National Bureau of Standards. (Supersedes LC577.)

LC668. Fifty books on horology.

LC669. List of Commercial Standards, revised to October 1, 1941. (Supersedes LC655.)

[2] Send orders for publications under this heading only to the Superintendent of Documents, Government Printing Office, Washington, D. C. Subscription to Technical News Bulletin, 50 cents per year; Journal of Research, $3.50 per year (to addresses in the United States and its possessions and to countries extending the franking privilege); other countries, 70 cents and $4.50, respectively.

RECENT BUREAU ARTICLES APPEARING IN OUTSIDE PUBLICATIONS [3]

Corrosion of dental alloys. Irl C. Schoonover and Wilmer Souder. J. Am. Dental Assn. (212 East Superior St., Chicago, Ill.) 28, 1278 (August 1941).

Combustion research in the U. S. A. Ernest F. Fiock. Aircraft Engineering (London, England) 13, No. 150, 221 (August 1941).

Photoelectric tristimulus colorimetry. Richard S. Hunter. One of six papers comprising a symposium on color—its specification and use in evaluating the appearance of materials. (Am. Soc. for Testing Materials, 260 So. Broad St., Philadelphia, Pa.) 61 (March 5, 1941).

Effect of rate of heating through the transformation range on austenitic grain size. S. J. Rosenberg and T. G. Digges. Trans. Am. Soc. for Metals (7301 Euclid Ave., Cleveland, Ohio) 29, 638 (September 1941).

Section on "Corrosion". H. S. Rawdon. Marks' Mechanical Engineers' Handbook, fourth edition (McGraw-Hill Book Co., 330 West 42d St., New York, N. Y.) 672 (1941).

Effect of freezing temperature in freezing-and-thawing tests of brick. Joseph C. Richmond and John W. McBurney. (Am. Soc. Testing Materials) Preprint 62 (1941).

[3] These publications are not obtainable from the Government. Requests should be sent direct to the publishers.

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